RK-Wi.232DTS-FCC and Wi.232DTS-FCC User's Manual

Rev 1.0.5

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1 Description

The RK-Wi.232DTS-FCC-FCC is a rapid-development/evaluation kit FCC pre-certified module, the FCC-Wi232DTS. When used within the guidelines presented in this document, no FCC part 15 testing/certification of the FCC-Wi232DTS is necessary in the end product.

Included in the kit is:

- 1-Rapid Development Case.
- 1-Rapid Development Utility and Documentation CD.
- 2-Wi.232DTS Rapid Development Boards.
- 2-FCC-Wi.232DTS pinned modules.
- 2-900 MHz antennas.
- 2-RS-232 cables.
- 2-USB cables.
- 6-AAA batteries.
- Startup Guide.

2 *RA*pid *D*evelopment Kit Setup

- Insert the AAA batteries into the evaluation PCB, observing the correct polarity.
- Insert an FCC-Wi.232DTS module into one of the evaluation boards, observing the correct orientation (see later in this document). The correct orientation of the module is with the antenna connector closest to the edge of the evaluation board. Make sure it is seated fully and correctly.
- Insert the other FCC-Wi.232DTS module into the other evaluation board, also observing the correct polarity.
- Connect antennas to FCC-Wi.232DTS modules.
- Connect evaluation boards to computers. If using USB communications, populate USB jumpers and remove RS-232 jumpers. If using RS-232 communications, populate RS-232 jumpers and remove USB jumpers.
- Install the RK-Wi.232DTS-FCC Windows software. If already installed, skip this step.
- Run the RK-Wi.232DTS-FCC software, select 2400 baud operation and navigate to the "Wireless Chat" tab.
- Power-On both evaluation boards, verifying that the version/copyright information is echoed to the screen from both modules.
- Chat back and forth between evaluation boards, verifying that serial and RF communications are successful.
- **IMPORTANT NOTE FOR HYPERTERMINAL USERS**: See section 4.1

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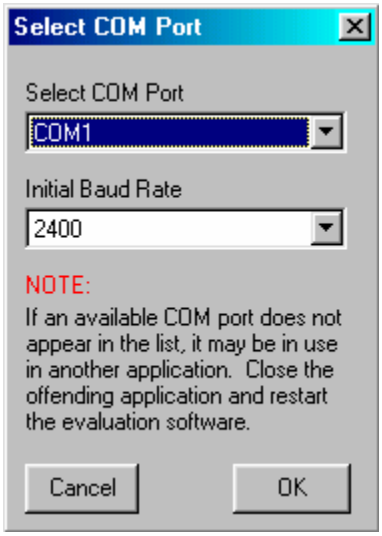
3 Using the RK-Wi.232DTS-FCC Evaluation Software

The software supplied with the RK-Wi.232DTS-FCC RadKit is used to read and set the volatile and non-volatile registers with the Wi.232DTS module. Refer to the Wi.232DTS Users Manual for more information on the register settings.

3.1 COM Port Setup and Selection.


Select COM Port
Select COM Port
COM1
Initial Baud Rate
2400
NOTE:
If an available COM port does not appear in the list, it may be in use in another application. Close the offending application and restart the evaluation software.
Cancel
OK

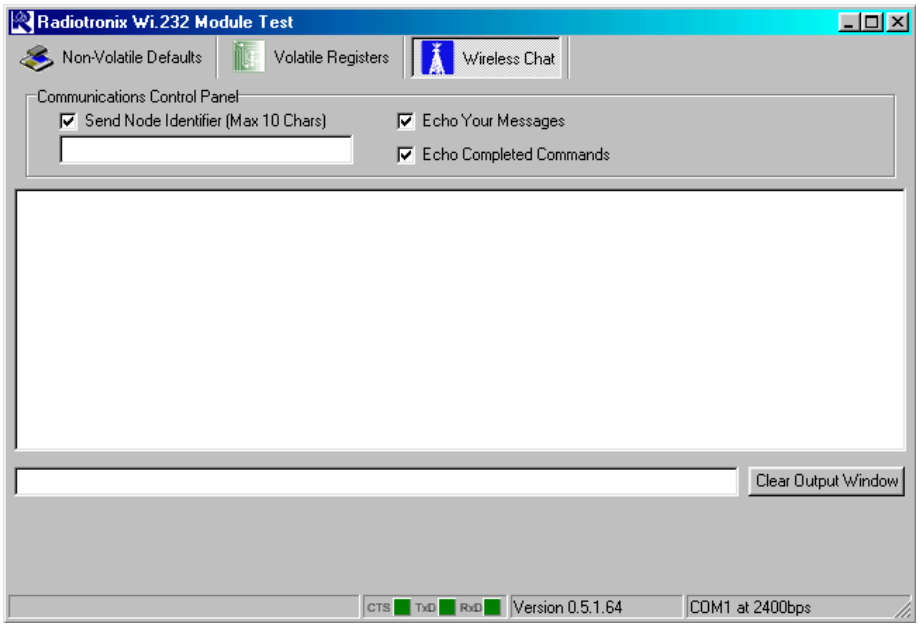
Upon starting the RK-Wi.232DTS-FCC evaluation software, you will be presented with a COM port selection dialog box. If you are using the USB interface, make sure that the evaluation board is already connected to the computer via the USB cable before you start the software. This will ensure that the virtual COM port which is assigned to the USB to UART bridge controller by Windows is visible in the COM port selection list.

The first time you start the RK-Wi.232DTS-FCC evaluation software, the Baud Rate should be left at 2400 baud, since this is the factory default baud rate setting for the module.

Tip: The RK-Wi.232DTS-FCC evaluation software does not autodetect the baud rate of the module. If you have changed the Non-Volatile Data Rate register, you will have to select the baud rate you set this register to when you start the RK-Wi.232DTS-FCC evaluation software.

3.2 Wireless Chat Page.

The Wireless Chat page in the RK-Wi.232DTS-FCC evaluation software demonstrates the capability of the Wi.232 to be used as a wireless communications link. The Rapid Development kit works as a wireless chat link with no register changes required, out of the box.



To Use Wireless Chat:

Type a message in the lower text field and press Enter. The text you typed will be displayed on the remote system, prefixed with a Node Identifier if you specified one.

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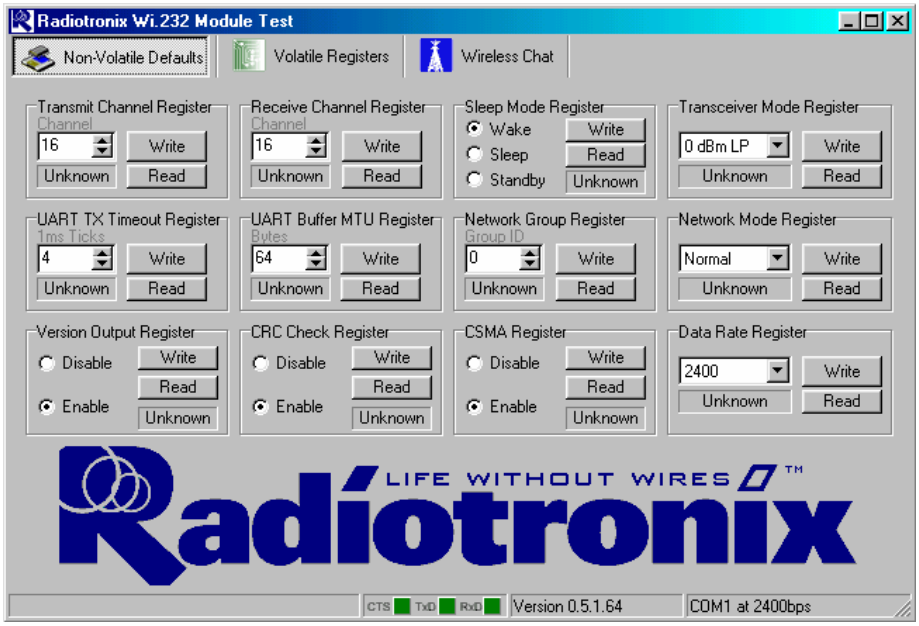
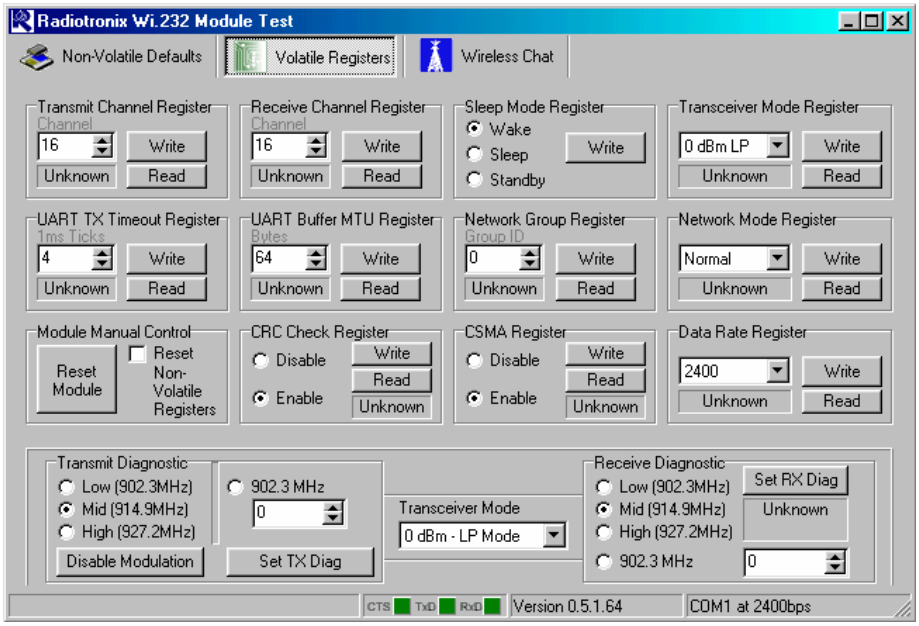
3.3 Non-Volatile Register Page.



The Non-Volatile Register page in the evaluation software allows you to change the default settings which will be loaded when the module is powered on.
It is important to note that data rates in excess of 19.2kbps cannot be achieved in LP mode due to bandwidth limitations.

Tip: If you change the Non-Volatile Data Rate setting, you will have to select the baud rate you set this register to when you start the RK-Wi.232DTS-FCC evaluation software.

3.4 Volatile Register Page



In this page, you can change the Volatile settings of the module. Values programmed into these registers are lost of power-down.

The page also provides a means of switching the receiver and transmitter on and off, setting receive and transmit channels, transceiver mode and modulation settings.

It is important to note that data rates in excess of 19.2kbps cannot be achieved in LP mode due to bandwidth limitations.

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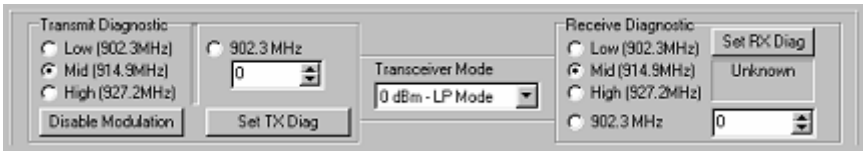
4 Using the Evaluation Software

4.1 Setting Register Values.

On both the Volatile and Non-Volatile pages, the registers are labeled by function. To set a register value, select the value from the options available for that register and click the "Write" button. To perform a read of that register, simply click the "Read" button. Descriptions of the register functions can be found in the Wi.232DTS Users Manual.

4.2 Diagnostic Mode Commands

There are a special class of commands available through the evaluation software. These controls are located on the "Volatile Registers" page as seen below.



These commands place the module into special diagnostic modes that can be used to test the module's performance, or to activate the transmitter for RF testing purposes. It is important to note that once a module executes a diagnostic command, it should be reset or have the power cycled to return to normal operation.

4.2.1 Transceiver Mode

This selects the modulation mode and power output of both the transmitter and receiver. The mode is not set until "Set TX Diag" or "Set RX Diag" is pressed. If "Set RX Diag" is pressed, the power output value is ignored.

4.2.2 Transmit Diagnostic

Transmit Diagnostic consists of four radio buttons which select the transmit channel. Low, Mid and High are quick reference buttons which can be used to select the lowest, the middle, or the highest channel. Any specific channel can be selected by using the controls below the "Set TX Diag" button.

The "Set TX Diag" button switches the transmitter on using the channel and mode selected in the channel selector and transceiver mode controls.

A "…1010101010101…" bit pattern is transmitted for bit error testing with another system or RF carrier analysis.

4.2.3 Receive Diagnostic

Receive Diagnostic consists of four radio buttons which select the transmit channel. Low, Mid and High are quick reference buttons which can be used to select the lowest, the middle, or the highest channel. Any specific channel can be selected by using the controls above the "Set RX Diag" button.

The "Set RX Diag" button switches on the receiver using the channel and mode selected in the channel selector and transceiver mode controls. Additionally, the module enters the diagnostic bit error test.

If a "…1010101010101…" bit pattern is received at the frequency and baud rate set up in the relevant registers, the BER test will return the number and percent of bit errors. This information is displayed in the panel below the "Set RX Diag" button. If no transmission is present, or the transmission is at the wrong frequency or data rate, the module may enter an infinite loop waiting for the beginning of the data. In this case, the module should be powered down and back up to return the module to its normal operating mode.

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5 Notes

5.1 Microsoft Windows / Hilgraeve HyperTerminal

The RK-Wi.232DTS-FCC Evaluation Kit can be used with HyperTerminal to receive and transmit RS-232 data and send files using file transfer protocols such as ZMODEM. HyperTerminal and many other terminal programs assert RTS by default. On the evaluation board, the RTS line is tied to the CMD pin on the module. When the CMD pin is held low, which is the case when the RTS line is asserted, the module will be placed in command mode.

In command mode, all UART data sent to the module will be interpreted as commands and will NOT be sent to the RF engine for transmission. Additionally, if an evaluation board is switched on in the presence of an asserted RTS line, it will perform a full hardware and flash reset to the factory defaults.

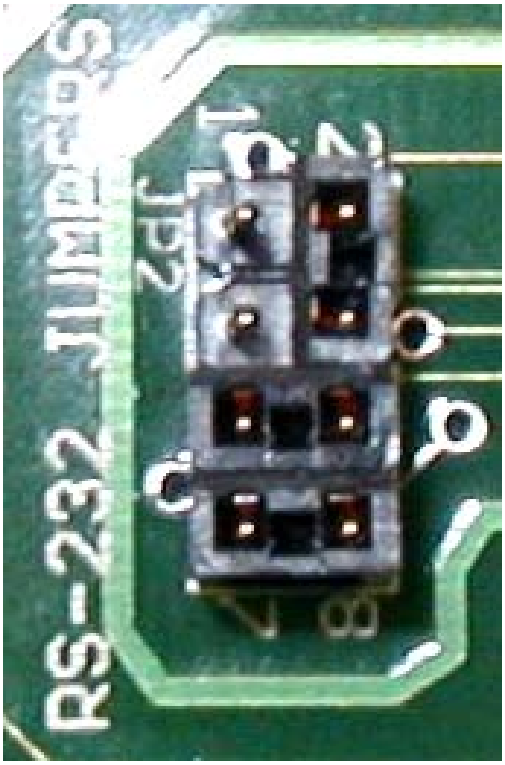
To use the evaluation board with HyperTerminal or other terminal program, you must first remove the jumpers from pins 7+8 of JP2, if you are using an RS-232 connection to your PC, or JP3, if you are using a USB connection to your PC. Removing this jumper will disconnect the RTS line from the CMD pin on the module, allowing normal operation.

5.2 Loopback Mode

The RK-Wi.232DTS-FCC kit can be operated in a loopback mode by configuring the COM jumpers in such a way as to link together the TXD and RXD lines to and from the module in the remote evaluation board.

Using this mode, the user can send data from their local evaluation board and have it re-transmitted back to them by the remote evaluation board. The maximum baud rate allowed in loopback mode is 38400 baud for point to point communications only.

Loopback mode using the RS232 jumpers:



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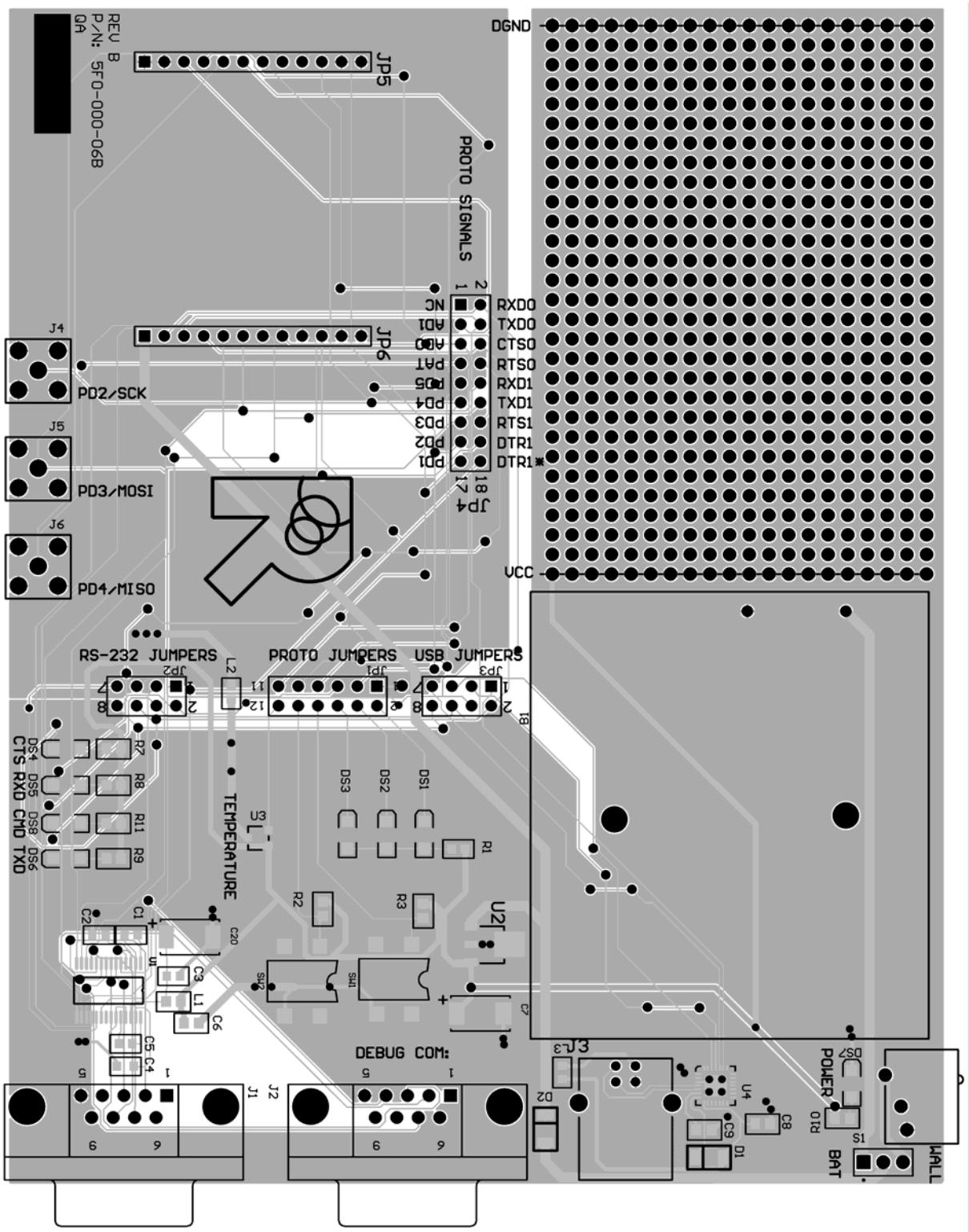
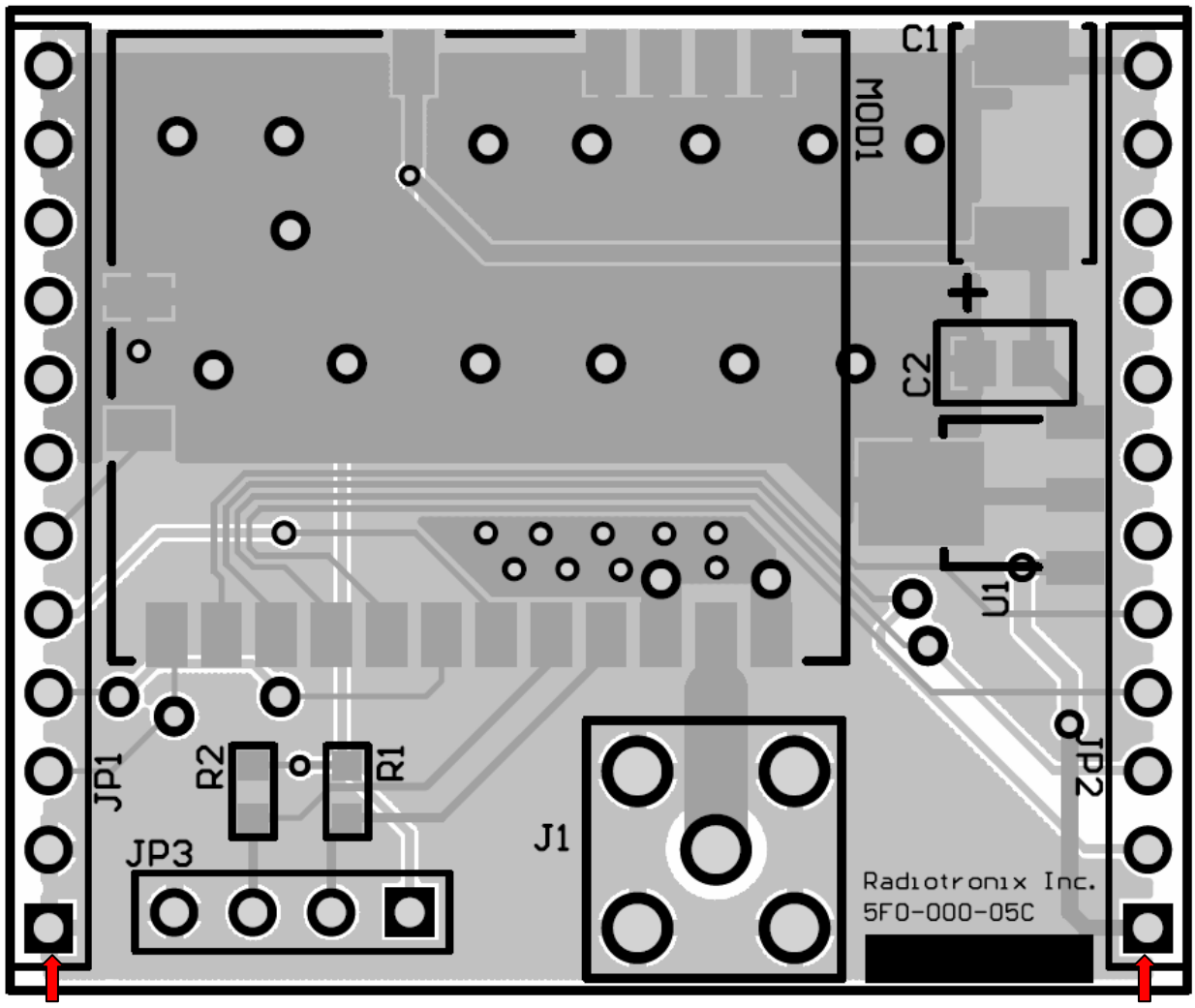
6 PCB Layout Diagrams

6.1 RK-Wi.232DTS-FCC Evaluation (Rapid Development) Board Layout



6.2 FCC-Wi.232DTS (EValuation Module) Layout



JP1 Pin 1 **JP2 Pin 1**

NOTE: Pin 1 of the FCC-Wi.232DTS module's JP2 aligns with Pin 1 of JP6 on the evaluation board. The following table lists the pin numbers and their assignments

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Pin Name	Pin Description
JP2 Pin 1	4V to 12V Vdd
JP2 Pin 2	RxD0, Wi.232DTS RxD pin
JP2 Pin 3	TxD0, Wi.232DTS TxD pin
JP2 Pin 4	CTS0, Wi.232DTS CTS pin
JP2 Pin 5	CMD (Active Low), Wi.232DTS CMD pin
JP2 Pin 6	RxD1 – Reserved for Future – No Connect
JP2 Pin 7	TxD1 – Reserved for Future – No Connect
JP2 Pin 8	RTS1 – Reserved for Future – No Connect
JP2 Pin 9	DTR1 – Reserved for Future – No Connect
JP2 Pin 10	DTR1* - Reserved for Future – No Connect
JP2 Pin 11	GND
JP2 Pin 12	GND
JP1 Pin 1	GND
JP1 Pin 2	GND
JP1 Pin 3	AD1 – Reserved for Future – No Connect
JP1 Pin 4	AD0 – Reserved for Future – No Connect
JP1 Pin 5	RSSI – Reserved for Future – No Connect
JP1 Pin 6	PD5 – Reserved for Future – No Connect
JP1 Pin 7	PD4 – Reserved for Future – No Connect
JP1 Pin 8	PD3 – Reserved for Future – No Connect
JP1 Pin 9	PD2 – Reserved for Future – No Connect
JP1 Pin 10	PD1 – Reserved for Future – No Connect
JP1 Pin 11	GND
JP1 Pin 12	GND

Table 1, FCC-Wi.232DTS Module Pinout

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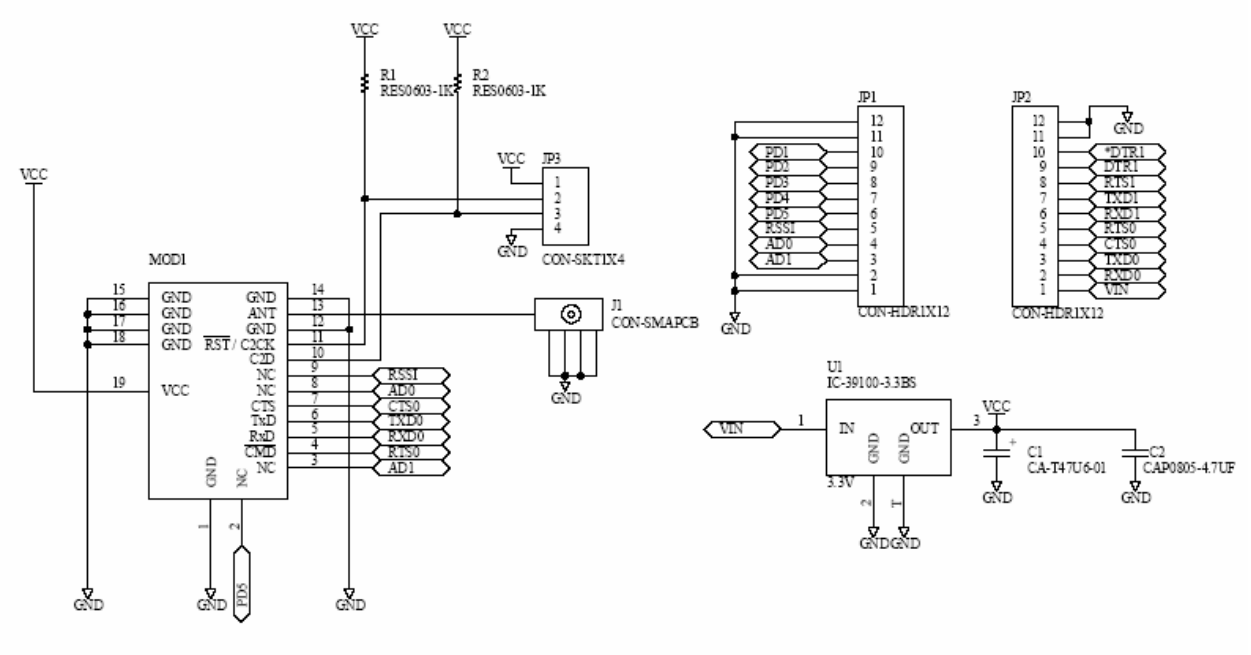
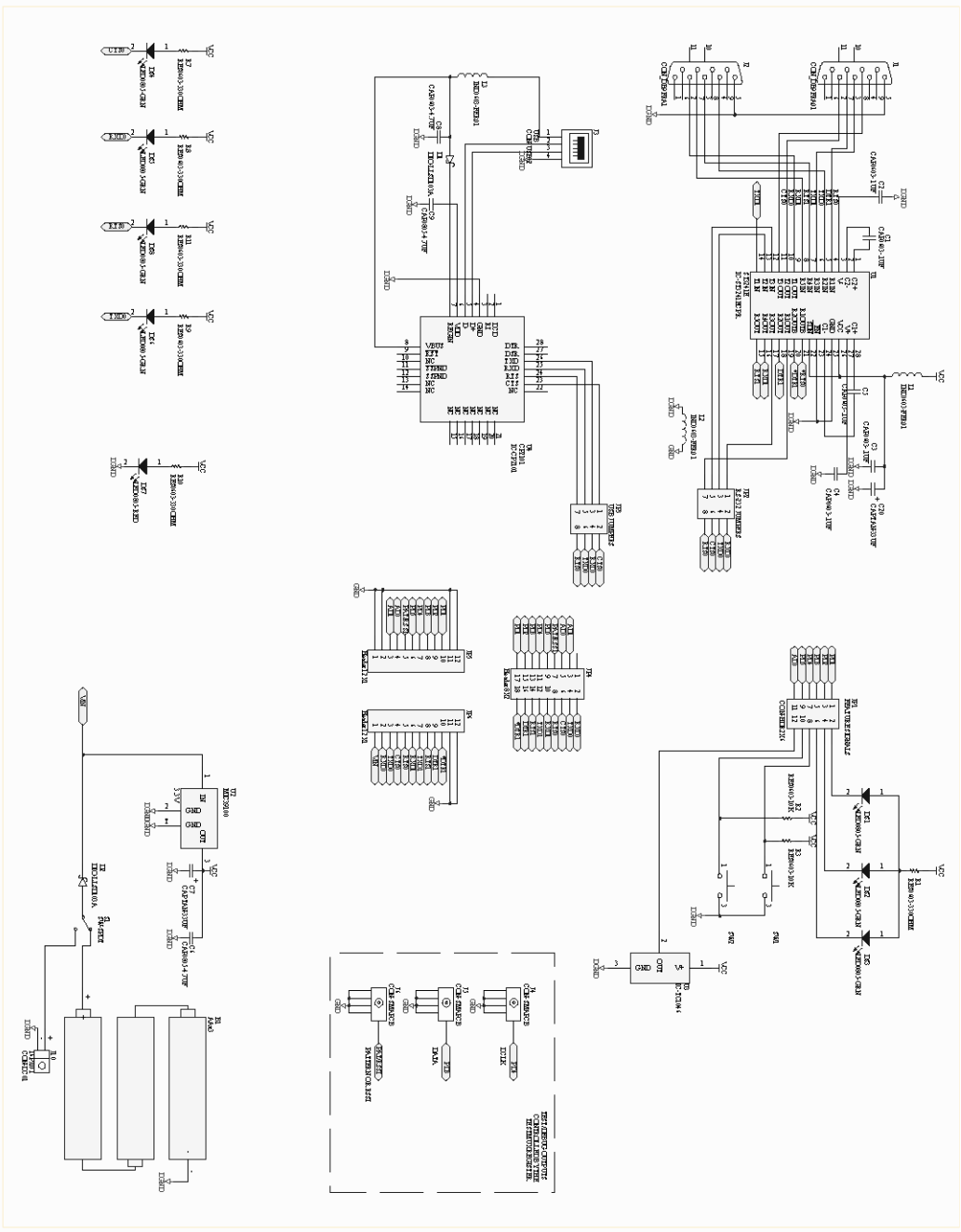
7 Schematic Diagrams

7.1 FCC-Wi232DTS Schematic Diagram



7.2 RK-Wi.232DTS-FCC Evaluation (Rapid Development) Schematic Diagram



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8 Usage Guidelines for FCC Compliance

The FCC-Wi232DTS modules included in this rapid development kit have been awarded a FCC modular approval. That means that this module, when integrated into your end product, requires no FCC part 15 testing as long as the following guidelines are met. Failure to meet any of the following guidelines will prevent the inheritance of the FCC modular certification.

8.1 Antenna Selection

In order to maintain compliance with FCC regulations, an antenna with no more than 3dBi gain must be used. This module has been tested with the following antennas:

Radiotronix Part Number	Antenna Type	Antenna Gain	DTS Mode	LP Mode
ANT-915-04A	RP ¼ Wave Helical	2dBi	Approved	Approved
ANT-915-02A	RP ¼ Wave Whip	3dBi	Approved	Approved
ANT-915-06A	RP ½ Wave Dipole	3dBi	Approved	NOT Approved

The module, when used in DTS mode, may be used with any of the above three antennas and maintain the requirements of the FCC grant. When operating the module in LP mode, it must be coupled to one of the approved ¼ wave antennas; in this mode, the module may not be used in conjunction with the ½ wave dipole antenna (see above).

An approved antenna must be directly attached to the module's reverse-polarity SMA connector in the final application to inherit the FCC modular certification.

8.2 Module Modification

The module must not be physically altered in any way. If any connections are made to the module that bypass the module pins, socket, or antenna connector, the FCC modular certification cannot be inherited.

8.3 End Product Labeling Requirements

Pursuant to FCC public notice DA 00-1407, the end product must be labeled on its exterior with the following verbiage:

"Contains FCC ID: Q7V-3F090003X"

8.4 Additional FCC Testing Requirements

While the module's FCC certification can be inherited (presuming the guidelines are met), additional testing will be required to achieve full FCC compliance for your end-product. The integrator is required to perform unintentional radiator testing on the final product per FCC sections 15.107 and 15.109. Additional, product-specific testing might be required. Please contact the FCC regarding regulatory requirements for your application.

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9 FCC Statements of Compliance

9.1 Statement and Conditions of Modular Compliance

FCC NOTICE (FCC ID: Q7V-3F090003X)

This device complies with the rules set forth in Part 15 by the Federal Communications Commission. Operation is subject to the following two conditions:

1) **This device may not cause harmful interference**
2) **This device must accept any interference received, including interference that may cause undesired operation.**

Any changes or modifications not expressly approved by Radiotronix, Inc. could void the user's authority to operate the equipment.

The FCC-Wi.232DTS module is provided with an inheritable FCC Modular Certification. This certification may be inherited in an end-user product, negating the need for FCC part 15 intentional radiator testing on this module, provided that the following guidelines are met:

1. **An approved antenna must be directly coupled to the module's RP-SMA connector.**
2. **The module must not be modified in any way. Coupling of external circuitry must not bypass the provided connectors.**
3. **End product must be externally labeled with "Contains FCC ID: Q7V-3F090003X"**
4. **The end product's user's manual must contain an FCC statement equivalent to that listed in section 9.2 of this manual.**
5. **The antenna used for this transceiver must not be co-located or operating in conjunction with any other antenna or transmitter.**
6. **The integrator must not provide any information to the end-user on how to install or remove the module from the end-product.**

The integrator is required to perform unintentional radiator testing on the final product per FCC sections 15.107 and 15.109.

FCC Pre-certified Wi.232DTS

FCC ID: Q7V-3F090003X

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9.2 Customer FCC Warning Requirements

The end-product user's manual must contain the following or equivalent verbiage.

FCC NOTICE (Containing FCC ID: Q7V-3F090003X)

The RF module (FCC ID: Q7V-3F090003X) contained within this device complies with the rules set forth in Part 15 by the Federal Communications Commission. Operation is subject to the following conditions:

1. **This device may not cause harmful interference**
2. **This device must accept any interference received, including interference that may cause undesired operation.**
3. **An approved antenna must be directly coupled to the module's RP-SMA connector.**
4. **The module must not be modified in any way. Coupling of external circuitry must not bypass the provided connectors.**
5. **The antenna used for this transceiver must not be co-located or operating in conjunction with any other antenna or transmitter.**

Any changes or modifications could void the user's authority to operate the equipment.

FCC Pre-certified Wi.232DTS

FCC ID: Q7V-3F090003X

9.3 Notices of Limitation

9.3.1 Product Testing

The integrator must still show that their product complies with FCC regulations applicable to their product. The integrator is not required to perform transmitter testing on the FCC-Wi.232DTS module, provided the guidelines in this document are met.

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